

On the Upper Cretaceous age and affinities of *Neocyprideis lusitanicus* (Ostracoda)

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ABSTRACT

Key words: Ostracoda; *Neocyprideis lusitanicus*; Late Cretaceous; Aveiro; Portugal.

Guernet & Lauerjat (1986) described a new species, *Neocyprideis lusitanicus*, from sediments deposited near Aveiro, Portugal. For these authors, some associated fossils (Molluscs, planktonic Foraminifera) indicated a Pliocene age. That seemingly was the first record of *Neocyprideis* in post-Miocene sediments in Europe.

A recent study of Upper Cretaceous material from the same region showed an abundant *Neocyprideis* fauna, associated with Charophyta. These *Neocyprideis* could be assigned without any doubt to *N. lusitanicus*. Therefore, *N. lusitanicus* appears as an Upper Cretaceous species, reworked in much later sediments, not Pliocene but Quaternary, as indicated by the planktonic Foraminifera assemblage. This interpretation is supported by:

1 - the incompatibility of the *Neocyprideis* (restricted to lacustrine-lagoonal environments) with abundant planktic Foraminifera;

2 - the occurrence of *N. lusitanicus* with Charophytes and non marine, cretaceous vertebrates but without the same Foraminifera.

Neocyprideis lusitanicus is a valid species, clearly different from the other late Cretaceous species (*N. coudouxensis* and *N. murciensis*) as well as the Early Miocene described species (*N. aquitana*, *N. janoscheki*).

RÉSUMÉ

Mots clés: Ostracoda; *Neocyprideis lusitanicus*; Crétacé supérieur; Aveiro; Portugal.

En 1986, Guernet & Lauerjat ont décrit une nouvelle espèce, *Neocyprideis lusitanicus*, dans des sédiments de la région d'Aveiro (Portugal). Pour les auteurs, quelques fossiles associés (mollusques, foraminifères planctoniques) permettaient de leur attribuer un âge pliocène. C'était apparemment la première apparition signalée du genre *Neocyprideis* en Europe après le Miocène.

L'étude récente d'un matériel très riche, de la même région et indubitablement d'âge Crétacé supérieur, a montré les mêmes *N. lusitanicus* associés à des gyrogonites de charophytes. On peut donc conclure que les *N. lusitanicus* des auteurs étaient un matériel remanié au Quaternaire (plutôt qu'au Pliocène) comme l'indique l'assemblage de foraminifères planctoniques. Cela est conforté à la fois par:

1 - l'incompatibilité écologique entre *Neocyprideis*, genre des milieux saumâtres à lagunaires, et des foraminifères planctoniques,

2 - la présence, fréquente dans tout le bassin, de charophytes et parfois de vertébrés non marins associés à *N. lusitanicus* sans faune de foraminifères.

N. lusitanicus semble être une espèce valable, car elle diffère nettement des autres espèces du Crétacé supérieur (*N. coudouxensi* et *N. murciensis*) et bien entendu des formes du Miocène inférieur (*N. aquitana*, *N. janoscheki*).

1. INTRODUCTION

In 1986, Guernet & Lauverjat described a new ostracod species, *Neocyprideis lusitanicus*, from supposedly Pliocene sediments from the region of Aveiro in Portugal. This attribution to Pliocene would mean that the genus *Neocyprideis* Apostolescu, 1956, previously unknown after the early Miocene, lived later. This was particularly important: it would be the first post-Miocene *Neocyprideis* record outside the Indo-Pacific realm.

For the authors, a pliocene age was proposed for *N. lusitanicus* after the study of some molluscs, and of an associated planktic Foraminifera assemblage. That is a problem, because *Neocyprideis* is generally considered as a brackish genus, and thus incompatible in the same biocoenosis with the planktic Foraminifera.

Our aim in this paper is first to show that in reality *N. lusitanicus* lived indeed during the late Cretaceous in brackish to freshwater environments, in association to Charophyta and vertebrates. Specimens from this species were reworked in later, certainly Quaternary times.

Furthermore, as we verified, *N. lusitanicus* is a sound species, different from the already described Cretaceous ones.

2. GEOLOGIC AND PALAEOLOGIC BACKGROUND

In his work on the Cretaceous System in Portugal, Paul Choffat (1900) dealt with the Late Cretaceous units between Aveiro and the southwest of Coimbra. These units are related — as the post-Cenomanian regression went on — to a shrinking gulf, much reduced in late Campanian times (Sandstones with *Hoplitoplacenticas* at Mira). These last marine, cretaceous deposits onshore are overlain by low salinity to freshwater, mostly clayey sediments ascribed to the Maastrichtian (the latest Cretaceous beds in the same region).

Choffat (1900, p. 209-211, 215, 219) recognized the presence of ostracods (*Cypris* sp.) sometimes in such huge numbers as to make up oolitic-like limestone lenses. That led him (*idem*, p. 210) to create the subunit IIa “Marnes et calcaires à *Cypris*” of his “Assises fluvio-marines”. Choffat (*idem*, p. 211) clearly defined the stratigraphic position of the “*Cypris*” occurrences, as well as the corresponding paleoenvironmental context: “... au dessus de la couche à *Hemitissotia*

[an ammonite that dates it — the “Grès de Picoto-Siadouro” — from the Coniacian; see Barbosa, 1981, p. 33] se trouvent des marnes plus ou moins feuilletées, de 1 à 2 mètres d'épaisseur, ayant vers leur sommet des plaquettes de calcaire blanc, à l'aspect marin, mais dont la faune est saumâtre. Les marnes et les calcaires contiennent par places des coquilles de *Cypris* en telle quantité, qu'elles forment presque entièrement la roche”.

The Stratigraphy and Palaeontology of the Aveiro area were dealt with again by J. Carrington da Costa (1937, among other papers). Costa refers the presence of ostracods (Costa, 1937, p. 10 quoting Choffat; p. 27-28). The so-called *Cypris* were regarded as brackish environment indicators. Costa (1937, table) ascribed all the concerned deposits to the unit he named “Fluvio-marinho ocidental do Norte de Febres ao Vouga e afloramentos de Portomar ao Mondego”. That was correlated by him to the Campanian and Maastrichtian, even if without any clearly established limit.

Other authors presented further data and viewpoints: Lauverjat & Pons (1978) conclude: “les nouvelles études de terrain confirment et précisent les observations de Carrington da Costa ..., bien qu'il existe un fort degré d'endémicité aussi bien dans la faune que dans la flore, un certain nombre d'éléments paléontologiques concurent à situer dans le Crétacé terminal l'âge de la série ...” (p. 131). In their paper, Gutiérrez & Lauverjat (1978) wrote: “Les Ostracodes qui sont parfois associés (correspondant à une population monospécifique de *Neocyprideis* sp.) ne sont pas sans rappeler ceux du Valdonnien provençal et des couches du Crétacé terminal non marin d'Espagne” (p. 109). Finally, Lauverjat (1982) indicates some levels with *Neocyprideis* from late Santonian and thinks that this level could be ascribed to Choffat's “marnes et calcaires à *Cypris*”.

Until much later, nobody ever questioned the Late Cretaceous age of the concerned ostracods.

The upper part of the Late Cretaceous yielded plant macrofossils, pollen & spores, and molluscs. It is rich in vertebrate fossils. There are excellent specimens from *Rosasia soutoi* Costa, 1940, a Bothremyd chelonian (Antunes & de Broin, 1988) that is common in Maastrichtian beds formerly exploited at Aveiro. There are many aquatic vertebrates, essentially freshwater ones as crocodiles, amphibians, and holostean fishes as gar-pikes (Lepisosteids) and a bowfin (Amiidae). Non aquatic vertebrates (squamates, small dinosaurs, mammals) are scarcer. Otherwise, rare sela-

chians, a few teleosteans as juvenile *Enchodus*, as well as young mosasaurs suggest some communication with the (not very close by) Atlantic and are compatible with low salinity waters (see Antunes & de Broin, *idem*).

The richness in vertebrates led one of us (M. T. A.) to research at Cerâmica do Vouga, Lda., a clay-pit near Vilar, Aveiro in 1968 and 1971 (see Antunes & de Broin, 1988). The site has been destroyed — only the upper part of the section can still be seen. During a field trip (1995) we (M. T. A.) found there many clayey blocks extremely rich in ostracods. Although they were not *in situ*, their origin from nearby Vilar was ascertained. This suggested a reevaluation of such fossils.

Furthermore, the complex problems related to the crisis of the end of the Cretaceous stress the interest of comparative studies with other regions. At Laño in northern Spain, a Maastrichtian vertebrate assemblage — that comprises elements in common with Aveiro and correlative sites in Portugal at Viso and Taveiro — similarly occurs higher than levels with ostracods (Astibia *et al.*, 1987). A *Neocyprideis* sp. is one of the ostracod forms found just immediately under the Maastrichtian of northwestern Spain (Babinot & Freytet [coord.], 1983).

Meanwhile, studies on abundant Late Cretaceous (Santonian to Maastrichtian) material from the Aveiro region appeared. The genus *Neocyprideis* was reported in association with charophyte gyrogonites (Lauverjat & Pons, 1978; Gutiérrez & Lauverjat, 1978; Lauverjat, 1982b; Guernet & Lauverjat, 1986, where they described *Neocyprideis lusi-tanicus*).

However, and quite surprisingly, *N. lusi-tanicus* was regarded as Pliocene in age. Obviously, the above referred context required a very cautious approach. The interpretation of a Pliocene age was indeed a risky one, since no pliocene deposits outcrop in the region nor have been recognized there before, nor any graben as well (Teixeira & Zbyszewski, 1976; Barbosa, 1981). The only supporting evidence that was pointed out (Lauverjat, 1982a; Guernet & Lauverjat, 1986) relied on water-borehole data. Among the fossils from these boreholes there are Bivalvia, the commonest one being the cockle *Cerastoderma edule*, still plentiful in the Aveiro region. Among the more than 20 gastropod forms referred to by Guernet & Lauverjat (*idem*, p. 84), only 3 would indicate a Pliocene age, and even so 2 of these supposedly characteristic

forms were not accurately identified at the species' level. One must recognize that all this is near worthless as a proof of a Pliocene age.

Otherwise there are good age indicators as planktic foraminifera from borehole samples near Aveiro regarded as correlative. The planktic foraminifera association comprises *Globigerinoides trilobus* (Reuss), *Globigerina bulloides* d'Orbigny, *Globigerina incompta* Cifelli and *Globorotalia truncatulinoides* (d'Orbigny). All these species live in the Atlantic. The corresponding time ranges are: *G. trilobus*, Lower Miocene-Recent; *G. bulloides*, Middle Miocene-Recent; *G. incompta*, Upper Miocene-Recent; and *G. truncatulinoides*, Lower Pleistocene to Recent (Levy *et al.*, 1995). Hence these associations are definitely not a proof of (or even consistent with) a Pliocene age: it is clearly Quaternary, about 2 Ma or less. It could well be Holocene.

Furthermore, all planktic foraminifera are marine, rarely marine lagoonal without salinity variations as in the marine part of the Arcachon bay (Le Campion, 1970). The planktic foraminifera association referred to above together with acknowledged brackish environment ostracods as *Neocyprideis* (and charophytes) would strongly lead to the suspicion of the mixed, reworked character of ostracods in a marine Quaternary context. The sediments that yielded the *N. lusi-tanicus* described by Guernet & Lauverjat (*idem*) are indeed Quaternary, as it could be expected. There is no whatsoever evidence of Pliocene in the Aveiro region. Therefore there is no need to think at "Pliocene" deposits spared by erosion in a graben. All this could have been ascertained in 1986. Confusion could have been avoided.

On the other hand, *N. lusi-tanicus* was described as a new species under the wrong belief of a Pliocene age. Comparisons have therefore been established only with Miocene species of the genus *Neocyprideis*, particularly *N. aquitana* Kollmann & Moyes, 1963 (non Moyes, 1965) (*N. fortisensis* and *N. janoscheki* are species of the genus *Miocyprideis* later defined by Kollmann, 1958 and are close by *Clithrocytheridea* — see Kollmann, 1958 and Colin *et al.*, 1990). No account at all was taken of earlier species, which are well represented in the Cretaceous even in the Aveiro region, as Guernet & Lauverjat (1986) acknowledged. As an obvious consequence, *N. lusi-tanicus* only can be regarded as a distinct species if it really differs from the older-than Miocene previously described species of the same genus. We have examined

different, upper Cretaceous mono-specific faunas with *Neocyprideis* from the Aveiro region and compared these faunas with paratypes of *N. lusitanicus*. All exactly belong to the same species.

Comparisons have also been made by us with other *Neocyprideis* species: *N. coudouxensis* Babinot, 1975, *N. iberiacus* (Grekoff & Deroo, 1956) and *N. murciensis* Damotte & Fourcade, 1971. These species are clearly different in shape, size, ornamentation, and in the nodes disposition. Other species as *N. durocortoriensis* Apostolescu, 1956, *N. apostolescui* (Keij, 1957), *N. williamsonnia* (Bosquet, 1852), from Cretaceous or Paleogene of Europa, America, Asia or Africa are also distinct. The closest form is a species in open nomenclature — *N. sp.* from the upper Maastrichtian of Peyrecave, Languedoc, France (Babinot *et al.*, 1996).

The genus *Neocyprideis* lived from middle Cretaceous (*N. vandenboldi* Gerry & Rosenfeld, 1973) to early Miocene (*N. aquitanica* Kollmann & Moyes, 1963). Probably derived genera and species still live in the lake Tanganyika (Ducasse & Carbonel, 1993, 1994).

3. CONCLUDING REMARKS

1. *Neocyprideis lusitanicus* is a “good species”, clearly different from the other upper Cretaceous and Paleogene species: *N. coudouxensis*, *N. iberiacus*, and *N. murciensis*; *N. apostolescui*, *N. williamsonnia*, *N. durocortoriensis*, *N. sp.* described by Tambareau and, of course, from the Early Miocene species as *N. aquitanica*.

2. The stratigraphic distribution of *N. lusitanicus* should be modified and ascribed to the Late Cretaceous, in agreement with the associated brackish to freshwater fauna and flora.

3. *N. lusitanicus* (that probably is the “*Cypris*” from the “couches à *Cypris*” of Paul Choffat) is the most common ostracod in these levels.

4. The Pliocene age attribution by Guernet & Lauverjat (1986) is not correct; the age of the studied sediments with reworked *N. lusitanicus* is indeed Quaternary.

5. The genus *Neocyprideis* lived from Middle Cretaceous (*N. vandenboldi* Gerry & Rosenfeld) to the Early Miocene (*N. aquitanica* Moyes).

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